Measurement of Road Dust Emissions: The TRAKER and PI-SWERL Tools

V. Etyemezian[a], H. Kuhns[a], J. Gillies[a], G. Nikolich[a], D. James[b], and S. China[b].

[a] Desert Research Institute, Division of Atmospheric Sciences, Las Vegas, NV
[b] Department of Civil & Environmental Engineering, University of Nevada, Las Vegas, Las Vegas, NV

Abstract

In some regions of the U.S., fugitive dust emissions are responsible for up to 60% of ambient PM10. Dust emissions from paved and unpaved roads can account for a substantial fraction of overall dust emissions. Facility-scale, local, and regional emission inventories are needed to estimate the contribution of road dust to the measured ambient PM10 and to ensure compliance with State Implementation Plans (SIPs), operating permits for facilities prone to dust emissions (such as mines and quarries), and transportation conformity rules.

The US EPA has provided guidance in its AP-42 document for estimating PM10 and PM2.5 dust emissions from paved and unpaved roads. Based on this guidance, measurements or estimates of silt loading and silt content have been widely used to estimate road dust emissions. However, use of silt parameters has several shortcomings: 1) On paved roads it is time-consuming and somewhat unsafe to conduct measurements due to the requirement that traffic be diverted around the measurement locations. 2) The silt parameter (roughly defined as particles smaller than 75 microns in physical diameter) is not a direct indicator for PM10 content (defined as particles with aerodynamic diameters smaller than 10 microns, 3) Because of the difficulty of making measurements, it is not always possible to obtain a large number of measurements to adequately represent spatial as well as temporal variations that are known to exist over a roadway network.

These shortcomings have motivated the development of vehicle-based platforms for more direct measurement of road dust emissions from both paved and unpaved roads. The TRAKER (Testing Re-entrained Aerosol Kinetic Emissions from Roads) is one such system that has been developed and improved over the last decade. The principle of the TRAKER is that dust concentrations measured behind the front tires of a test vehicle are related to emissions of PM10. Use of the TRAKER greatly facilitates measuring road dust emission factors over large areas.

More recently, the use of a wind tunnel-type device, the PI-SWERL, on paved roadways has been pioneered by researchers at UNLV. Providing a somewhat different measurement method than the TRAKER, the PI-SWERL allows for quantifying emissions associated with aerodynamic entrainment of particles, benefits of surface treatments, as well as effectiveness of near-road control measures.